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December 4, 2003

Scott W. Cummings  
Burns, Doane, Swecker & Mathis  
P.O. Box 1404  
Alexandria, VA 22313 1404

In re application of:  
Mathias Berglund et al            DECISION ON PETITION  
Serial No.: 09/878,240  
Filed: June 12, 2001  
For: TWO-PIECE ROTARY METAL-CUTTING TOOL AND METHOD FOR  
INTERCONNECTING THE PIECES

This is a decision on the petition received by fax on November 18, 2003, to withdraw the holding of abandonment in the above-identified application.

The above-identified application became abandoned for failure to reply within the meaning of 37 C.F.R. 1.113 in timely manner to the Reissue Supplement Notice to File Missing Parts of Application mailed on July 18, 2001. Which set a shortened statutory period for reply of two (2) months. Accordingly, this application became abandoned September 19, 2001.

On November 18, 2003, the office received a communication from the attorney of record. Enclosed was an acknowledgement that the attorney never received the Reissue Supplement Notice to File Missing Parts Application mailed on July 18, 2001.

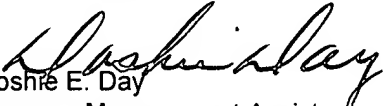
The petition is hereby GRANTED.

The evidence submitted is sufficient to establish that the petitioners did not received the Reissue Supplement Notice to File Missing Parts Application mailed on July 18, 2001.

The application will be complete with the faxed documents received on October 1, 2001 and released to Technology Center 3722.

The Office regrets any inconvenience this may have caused the client.

Telephone inquiries concerning this matter may be directed to Doshie E. Day  
(703) 308-3640.

  
Doshie E. Day  
Program Management Assistant  
Office initial Patent Examination

**BURNS DOANE**BURNS DOANE SWECKER & MATHIS LLP  
ATTORNEYS AT LAWALEXANDRIA, VIRGINIA  
REDWOOD SHORES, CALIFORNIA  
DURHAM, NORTH CAROLINA**REPLY TO:**  
P.O. Box 1404  
Alexandria, Virginia 22313-1404**TELEPHONE:** +1.703.836.6620**FACSIMILE:** +1.703.836.2021 (Group 3)  
+1.703.836.0028 (Group 4)**DATE:** November 18, 2003

RECIPIENT INFORMATION	SENDER INFORMATION
To: Ms. McDowell	From: Scott W. Cummings
Voice Tel. No.: 703-308-9477	Voice Tel. No.: 703-838-6680
Fax Tel. No.: 703-308-7749	Sent By: G. Harrell
Your Ref.:	Our Ref.: 024444-902
	Total Pages (Incl. Cover Page): 23

**RE:** U.S. Patent Application No. 09/878,240**MESSAGE:**

Per your request, please see the attached.

**NOTE:** The information contained in this facsimile message is attorney-client privileged and contains confidential information intended only for the use of the person(s) named above and others expressly authorized to receive it. If you are not the intended recipient, you are hereby notified that any dissemination, distribution or copying of this message is prohibited and you are asked to notify us immediately by telephone and to return this message to us by mail without copying it.

Patent  
Attorney's Docket No. 024444-902

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of	)	
	)	
Mattias BERGLUND et al.	)	Group Art Unit: 3722
	)	
Application No.: 09/878,240	)	Examiner: Unassigned
	)	
Filed: June 12, 2001	)	Confirmation No.: 3796
	)	
For: TWO-PIECE ROTARY METAL-	)	
CUTTING TOOL AND METHOD	)	
FOR INTERCONNECTING THE	)	
PIECES	)	

**REQUEST/PETITION TO ACCEPT MISSING PARTS AS BEING  
TIMELY FILED DUE TO NON-RECEIPT OF OFFICIAL COMMUNICATION**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

Applicants transmit herewith a copy of U.S. Patent No. 5,971,673 in double-column format pursuant to 37 C.F.R. § 1.173(a)(1) for the above-identified application.

***RELIEF REQUESTED***

Applicants respectfully request that the attached patent copy be considered as being timely submitted, and that Applicants not be charged with an extension of time under the provisions of 37 C.F.R. § 1.17. To the extent that Applicants are charged with such an extension of time, this paper should be considered as a request for a refund of any charged extension of time fees in connection with the filing of missing parts in this application.

**DOCKETED**  
**filed 10-23-03**

A3

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Application No. 09/878,240  
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Should the application be considered abandoned, it is requested that the holding of abandonment be withdrawn.

***STATEMENT OF PERTINENT FACTS***

On June 12, 2001, Applicants' representative prepared and filed the present application in the U.S. Patent and Trademark Office. The application was accompanied by a copy of the above-mentioned patent, a transmittal form, a Preliminary Amendment, a check in the amount of \$950.00, a Declaration in Support of Reissue, an offer to surrender the patent, and assent of the assignee, Power of Attorney and a statement under 37 C.F.R. §3.73(b) (see, e.g., the Reissue Patent Application Transmittal Letter submitted with said application on June 12, 2001).

On July 23, 2001, Applicants received a Filing Receipt having a mailing date of July 18, 2001.

On October 1, 2001, Applicants filed a Supplemental Declaration in Support of Reissue.

On November 5, 2001, Applicants received a Notice of Publication of Application.

Having not received any further communications from the Patent Office, Applicants filed a written Status Inquiry on December 16, 2002. To date, there has been no reply to Applicants' Status Inquiry.

On September 8, 2003, Applicants' representative contacted the Office of Initial Patent Examination (OIPE) by telephone to inquire about the status of the application.

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Subsequent calls were also placed on September 24, 2003 and September 29, 2003, also attempting to ascertain the status of the case.

On October 14, 2003, Applicants' representative spoke by telephone with Ms. Linda McDowell, who was able to ascertain from the file that, according to the Patent Office's records, a Notice to File Missing Parts was mailed to Applicants on July 18, 2001, and that no response to the Notice has been received from the Applicants. Applicants' representative requested that a copy of the Notice be faxed to him. Apparently, the actual Notice to File Missing Parts is also absent from the Patent Office file, however, Applicants did receive a copy of a Reissue Supplement to a Notice to File Missing Parts of Application with a mailing date of July 18, 2001. A copy of this document (received on October 14, 2003) is attached.

Applicants never received a copy of the Notice to File Missing Parts or the Reissue Supplement, prior to October 14, 2003.

Attached to this paper is a copy of Applicants' representative's docket record in which any such Notice to File Missing Parts with a mailing date of July 18, 2001 would have been recorded for this application (Attorney reference 024444-902) if received. As indicated by the attached record, no such Notice was ever recorded. The attached docket record has been redacted to protect clients' confidential information.

Thus, Applicants have established non-receipt of the Official Communication pursuant to the procedures outlined, for example, in MPEP § 711.03(c).

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### ***DISCUSSION***

Based on the above, it is clear that Applicants' representative did not receive a Notice to File Missing Parts in the above-identified application.

Upon detection of the error, the attached response supplying the missing requirements in the above-identified application have been timely prepared and filed.

Therefore, Applicants respectfully request that the attached patent copy be considered as having been timely filed and that no extensions of time be charged under the circumstances discussed above.

While Applicants do not believe that a petition is necessary under the circumstances, to the extent that the relief requested requires a petition, this paper should be considered as a Petition pursuant to the provisions of 37 C.F.R. § 1.181 to accept the attached patent copy as satisfying the requirements for filing the above-identified application in a timely manner and/or to withdraw a holding of abandonment. Applicants' representative hereby authorizes any necessary charges in connection with this Request/Petition to be charged to Applicants' representative's Deposit Account No. 02 4800, and to credit Applicants' representative's Deposit Account with any refunds or overcharges.

### ***CONCLUSION***

For these reasons noted above, Applicants respectfully request the attached patent copy be accepted without a charge for a petition and/or an extension of time. Should any further questions arise with regard to the above, it is requested that the undersigned be

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contacted so that any such issues may be adequately addressed and prosecution of the  
instant application expedited.

Respectfully submitted,

BURNS, DOANE, SWECKER &amp; MATHIS, L.L.P.

Date: October 23, 2003By: 

Scott W. Cummings

Registration No. 41,567

P.O. Box 1404  
Alexandria, Virginia 22313 1404  
(703) 836-6620

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Application Number: 09/878 240

Attachment to Paper No.:

Date Mailed 07/18/01

REISSUE SUPPLEMENT  
NOTICE TO FILE MISSING PARTS OF APPLICATION

This Reissue Supplement is an attachment to:

- ☐ 'Notice to File Missing Parts of Application' Filing Date Granted
- ☐ 'Notice of Incomplete Application' No filing Date Granted

The item(s) indicated below as missing must be filed within the period for reply set on the attached form to avoid abandonment.

Correction of the following is required to complete the reissue application:

- ☒ 1. The reissue specification has not been provided in double-column format as is required by 37 CFR 1.173(a)(1).
- ☐ 2. Consent of the assignee is missing. 37 CFR 1.172 requires that the reissue oath/declaration be accompanied by the written consent of all assignees.
- ☐ 3. Consent of the assignee is present, but is unsigned. A statement of consent bearing the signature of an official authorized to act on behalf of the assignee(s) must be provided.
- ☐ 4. Assignee's statement under 37 CFR 3.73(b) establishing ownership of the patent is missing. 37 CFR 1.72 requires that all assignees consenting to the reissue establish their ownership interest in the patent by filing in the reissue application a statement in accordance with 37 CFR 3.73(b). See MPEP Sec. 324.
- ☐ 5. Assignee's statement under 37 CFR 3.73(b) is present, but is unsigned. A 37 CFR 3.73(b) statement bearing the signature of an official authorized to act on behalf of the assignee must be provided.

*C. M. Lyund*  
Customer Service Center  
Initial Patent Examination Division (703) 308-1202

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OCT 14 2003

BURNS DOANE  
SWECKER & MATHIS, LLP.

## Printed: 9/18/01

**Through: 9/19/01**

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ATTY/ATTY2		REFERENCE#	TITLE / MARK	CLIENT	REG/SERIAL#	ACTION	CURRENT EXT	EXT AVAILAB	Page
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8 Tue RLG/ARB/	028870-201				Annuity Due	0	1 Ex/6 Mnth
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8 Tue RLG/ARB/	028870-202				Annuity Due	0	1 Ex/6 Mnth
8 Tue REK/CK/	029300-274				Action Needed	0	None
8 Tue AEK/	028866-008				Filing Details	0	None
8 Tue CFW/JLC/	030681-140				SC - Issue Notify	0	None
8 Tue CFW/	030681-158				Response to OA	0	3 Ex/1 Mnth
8 Tue CFW/	030681-309				Inf Disclosure Stmt	0	3 Ex/1 Mnth
8 Tue REK/MDR/	031994-025				Notice of Appeal	0	3 Ex/1 Mnth
8 Tue REK/MDR/	031994-025				Final Rejection Resp	0	3 Ex/1 Mnth
8 Tue REK/	031994-183				Resp to Invitation	0	1 Ex/1 Mnth
8 Tue REK/JPO/	032001-031				SC - 1st OA	1	None
8 Tue REK/	032001-050				SC - File Application	8	3 Ex/1 Mnth
8 Tue REK/AJC/	032005-097				Inf Disclosure Stmt	1	2 Ex/1 Mnth
8 Tue EJG/	032013-023				SC - 1st OA	0	None
8 Tue WGR/AJC/	032224-008				Response to OA	0	None

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18:05

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18 Tue	RLG/-/-	019570-174.001				Notice of Appeal	1	2 ExU/1 Mn
18 Tue	SCM/TSR/DMG	020600-285				Response to OA	1	2 ExU/1 Mn
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18 Tue	PNM/RS/JEME	006838-030	[REDACTED]	[REDACTED]	[REDACTED]	Response to OA	2 1 ExU1 M
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18 Tue	WCR/-/-	015291-024	[REDACTED]	[REDACTED]	[REDACTED]	Response to OA	0 3 ExU1 M
18 Tue	CFW/-/-	015955-006	[REDACTED]	[REDACTED]	[REDACTED]	SC - Missing Parts	0 No
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18 Tue	REK/GFS/RMH	018240-029	[REDACTED]	[REDACTED]	[REDACTED]	SC - File Application	1 Non
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18 Tue	REK/GFS/RMH	018240-040	[REDACTED]	[REDACTED]	[REDACTED]	SC - File Application	0 1 ExU1 M
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BURNS DOANE



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13 Thu	MAD/-/-	032055-019					30 Mo Instruct Req	0		18:04
15 Sat	GFS/-/-	002010-651					Power Attorney Due	1		18:04
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15 Sat	AXW/-/DBM	032390-053					Resp to Invitation	0		18:04
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17 Mon	RLG/KBL/SMS	027557-099					SC-File Application	0		18:04
7 Mon	TGD/KJW/-	033297-100					SC-File Application	0		18:04
8 Tue	PNM/-/-	000400-865					File Convention Appl	0		18:04
8 Tue	GFS/MAD/MAD	000476-173					Action Needed	0		18:04
8 Tue	RLG/MGS/MJC	000500-103					Final Rejection Resp	0		18:04



## United States Patent [19]

Berglund et al.

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[45] **Date of Patent:** Oct. 26, 1999

- [54] TWO-PIECE ROTARY METAL-CUTTING  
TOOL AND METHOD FOR  
INTERCONNECTING THE PIECES

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- [73] Assignee: Seco Tools AB, Fagersta, Sweden

- [ \* ] Notice: This patent is subject to a terminal disclaimer.

- [21] Appl. No.: 09/159,584

- [22] Filed: Sep. 24, 1998

### Related U.S. Application Data

- [63] Continuation of application No. 08/929,462, Sep. 15, 1997.

**[30] Foreign Application Priority Data**

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- [51] Int. Cl.<sup>6</sup> ..... B23B 51/00

- [52] U.S. Cl. .... 408/1 R; 76/108.6; 408/144;  
408/226; 408/230; 408/231

- [58] Field of Search ..... 408/1 R, 144,  
408/199, 200, 226, 227, 230, 231, 232;  
76/108.6, 108.1

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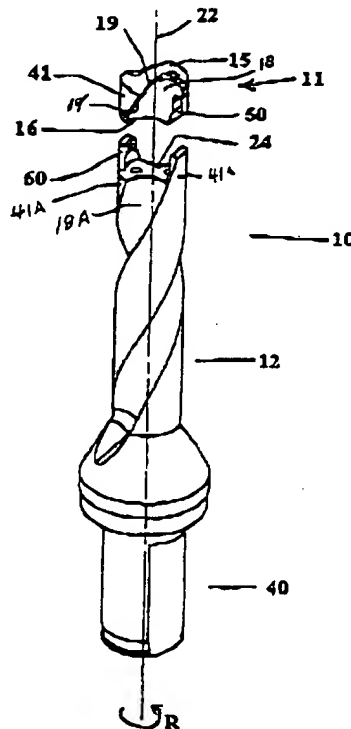
*Primary Examiner*—Daniel W. Howell

Attorney, Agent, or Firm—Burns, Doane, Swecker & Mathis, L.L.P.

[57]                      **ABSTRACT**

A tool includes a tool body and a cutting portion detachably mounted thereon, the tool being rotatable about a longitudinal center axis. The tool body includes flutes formed in an outer surface thereof, and a pair of forward projections at a front end thereof. The cutting portion includes front flutes formed in an external side thereof, and a pair of recesses extending circumferentially in communication with respective ones of the front flutes. To connect the cutting portion to the tool body, the cutting portion and tool body are converged longitudinally so that the projections enter the front flutes. Then, relative rotation is produced between the cutting portion and tool body to align the front flutes with the rear flutes while causing the projections to enter the recesses and form therewith a bayonet coupling.

**15 Claims, 4 Drawing Sheets**



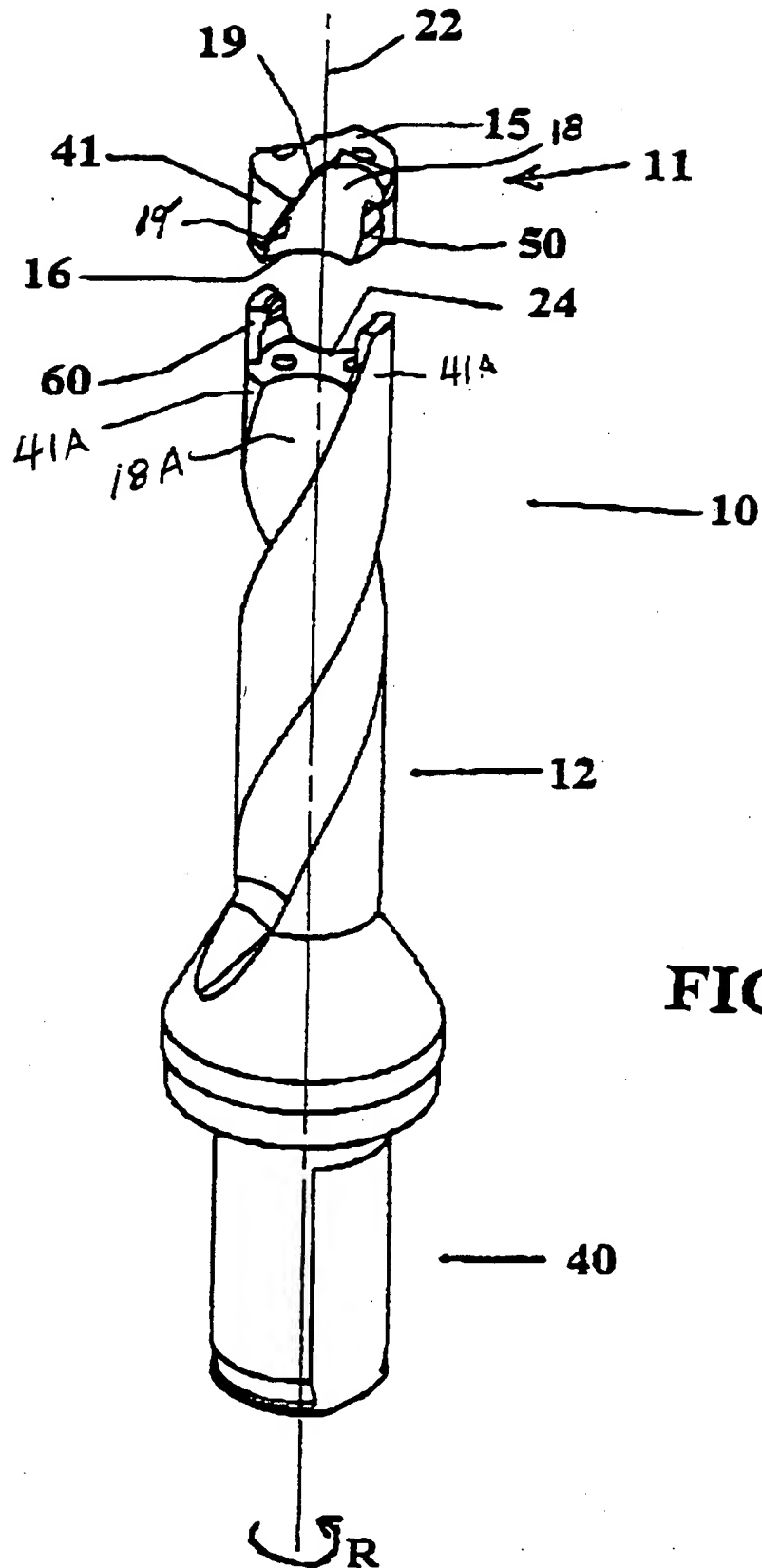


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Fig. 2

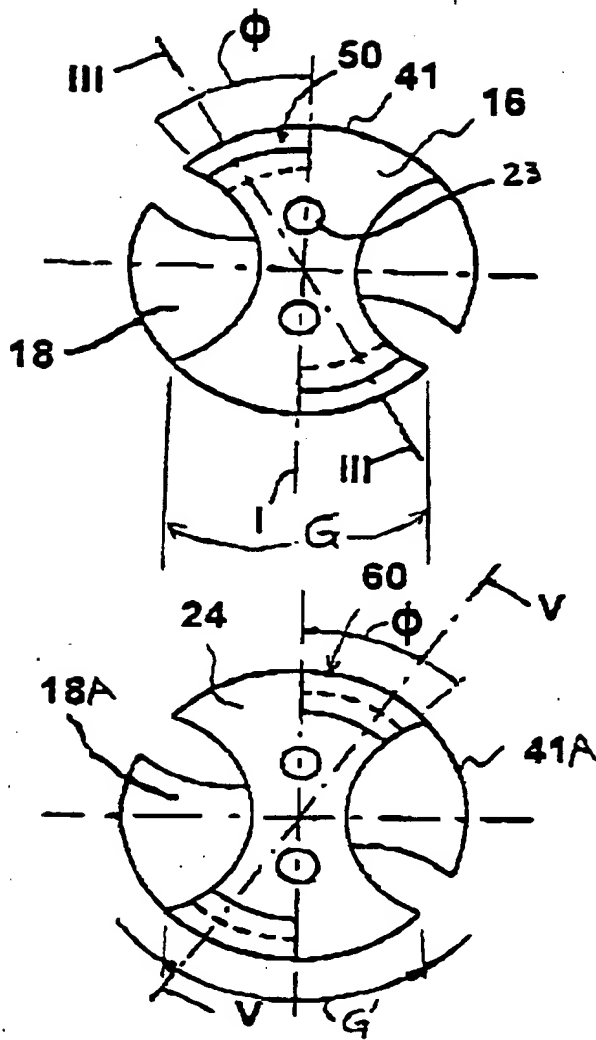


Fig. 4

Fig. 3

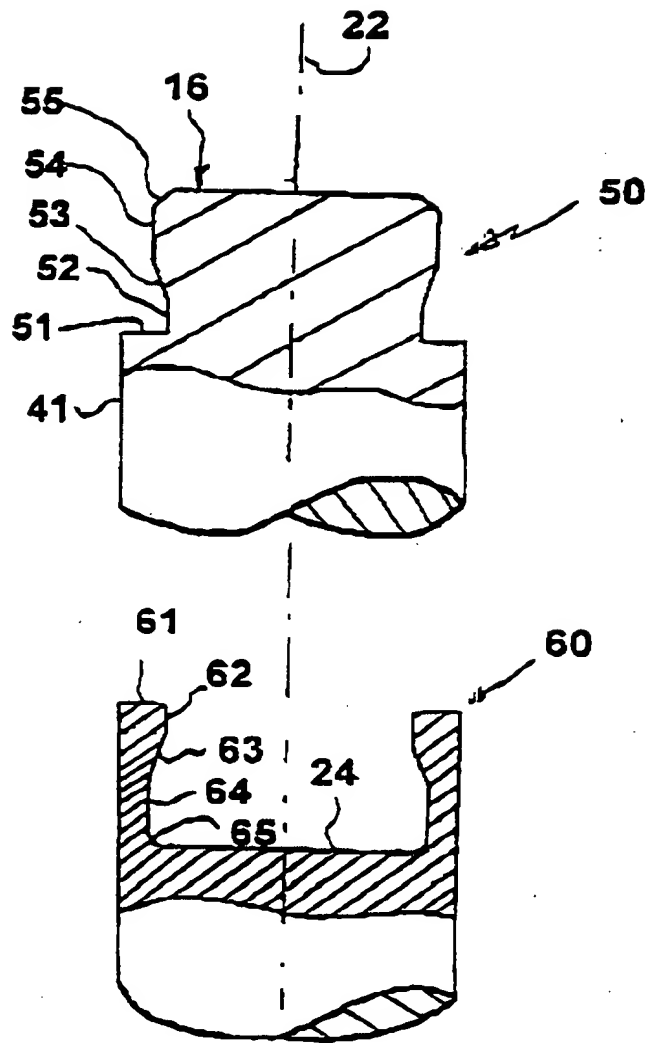


Fig. 5



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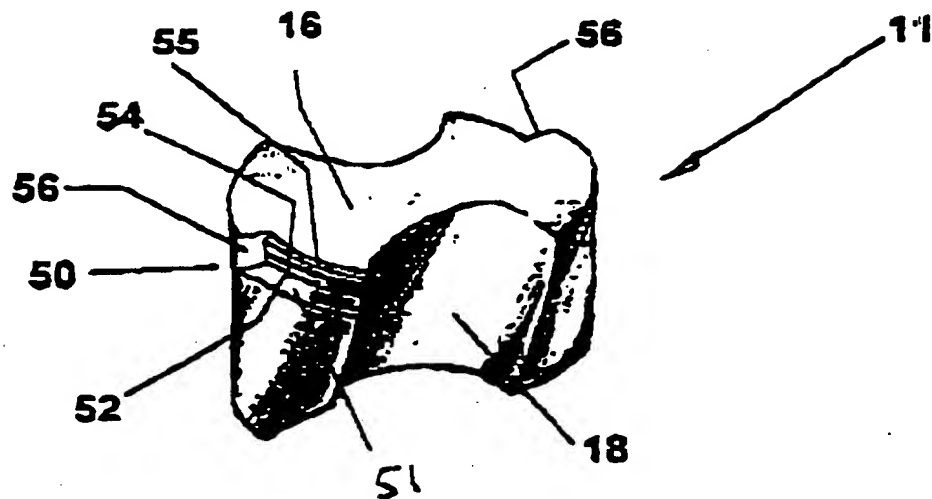


Fig. 3A

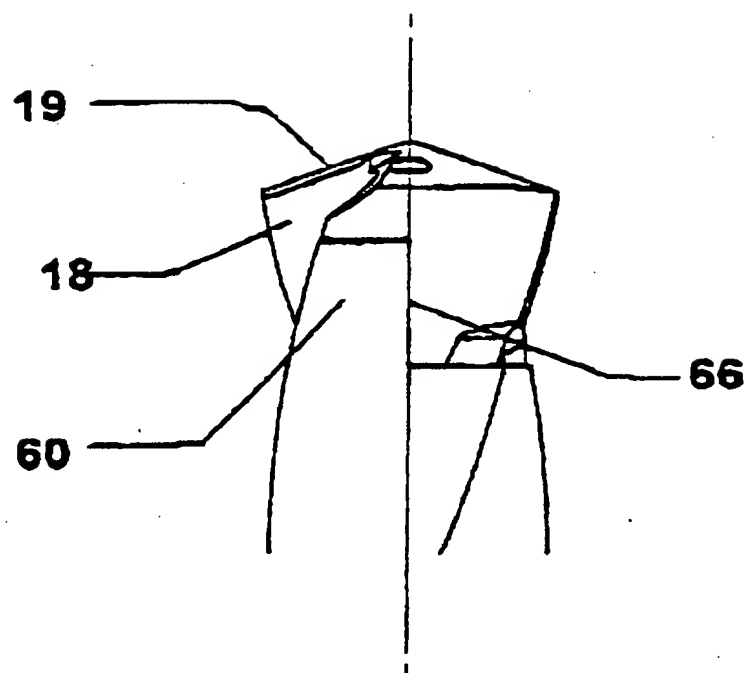


Fig. 9

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## TWO-PIECE ROTARY METAL-CUTTING TOOL AND METHOD FOR INTERCONNECTING THE PIECES

This application is a continuation of application Ser. No. 08/929,462, filed Sep. 15, 1997.

### BACKGROUND OF THE INVENTION

The present invention relates to a tool for rotary, cutting machining, comprising a tool body and a cutting portion. The tool body has a front surface, and the cutting portion has a support surface provided to releasably abut against the front surface in a substantially radial plane. The tool body and the cutting portion comprises means which cooperate for holding them together. The invention also relates to a cutting portion and a tool body as well as a method for mounting a cutting portion to a tool body.

### PRIOR ART

It is previously known to use interchangeable cutting edges on different types of tools for cutting machining, especially when cutting a metallic workpiece. This technique however has practical limitations due to handling reasons when it comes to milling and drilling tools which rotate around a longitudinal axis.

Through DE-PS-367,010 and Burger U.S. Pat. No. 2,259,611, it is previously known to provide drills with lockable drill tips, wherein the drill tip is retained with the aid of dove-tail profiles or with press fit, respectively. The known tools however are impaired with drawbacks such as bad torsion transferring ability and troublesome mounting and dismounting.

The present invention has as one object to provide drilling and milling tools with interchangeable cutting edges, which eliminates problems associated with known techniques.

Another object with the present invention is to provide a rigid tool preferably for drilling or milling wherein the cutting portion cooperates with the tool body via a bayonet coupling.

Another object of the present invention is to provide a rigid tool preferably for drilling or milling wherein the cutting portion can be easily exchanged by hand without time consuming screwing or soldering.

Another object of the present invention is to provide a tool with a self centering cutting portion.

### SUMMARY OF THE INVENTION

These and other objects have been achieved by the present invention which relates to a rotary metal-cutting tool comprising, in combination, a tool body and a cutting portion attached to the tool body. The tool body includes a shank portion defining a longitudinal center axis, a front surface, and rear chip flutes formed in an external side surface of the shank portion for guiding chips rearwardly during a cutting operation. The cutting portion includes a rear support surface abutting the front surface, a front cutting face, and front chip flutes formed in a side surface of the cutting portion and intersecting the cutting face to form cutting edges therewith. The tool body and cutting portion are interconnected by a bayonet coupling formed by projections disposed on one of the tool body and cutting portion, and recesses formed in the other of the tool body and cutting portion. The projections are circumferentially offset with respect to the flutes and extend generally longitudinally. The recesses extend circumferentially from

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respective flutes. The flutes are sized to longitudinally receive respective projections during longitudinal insertion or removal of the cutting portion relative to the tool body. The cutting portion is rotatable about the center axis relative to the tool body to transfer the projections from the respective flutes and into the recesses while bringing the front flutes into alignment with the rear flutes.

The invention also relates to a method of mounting a cutting portion to a tool body to form a metal-cutting rotary tool. The tool body includes a shank portion, a front surface, and rear chip flutes formed in an outer surface of the tool body. The cutting portion includes a support surface abutting the front surface, a cutting surface having cutting edges, and front chip flutes formed in an outer surface of the cutting portion. One of the tool body and cutting portion includes longitudinal projections, and the other of the tool body and the cutting portion includes circumferential recesses. Each recess communicates with a respective flute and extends less than 180°. The method comprises the steps of:

- A) converging the cutting portion and tool body longitudinally toward one another to bring the projections into respective ones of the flutes that communicate with the circumferential recesses; and
- B) effecting relative rotation between the tool body and cutting portion to cause the projections to enter respective ones of the recesses to bring the front flutes into alignment with the rear flutes and to bring a stop surface of each projection into longitudinally opposing relationship with a stop surface of a respective recess for defining a bayonet connection preventing longitudinal displacement of the cutting portion relative to the tool body.

### DESCRIPTION OF THE DRAWINGS

The objects and advantages of the invention will become apparent from the following detailed description of a preferred embodiment thereof in connection with the accompanying drawing in which like numerals designate like elements, and in which:

FIG. 1 shows a drilling tool according to the present invention, in an exploded perspective view;

FIG. 2 shows a cutting portion according to the present invention in a bottom view;

FIG. 3 shows the cutting portion in a sectional view taken along the line III—III in FIG. 2;

FIG. 3A shows the cutting portion in a perspective view from below;

FIG. 4 shows the forward end surface of a tool body according to the present invention in top view;

FIG. 5 shows the drill shank in a sectional view taken along the line V—V in FIG. 4;

FIGS. 6, 7 and 8 show cross-sections of a bayonet coupling of the tool;

FIG. 9 shows the assembled tool according to FIG. 1 in a magnified side view.

### DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

The embodiment of a tool 10 according to the invention shown in FIG. 1 is a so called helix drill, which comprises a cutting portion or drill tip 11 and a drill body 12. The drill has a rotational direction R.

The drill tip 11 is provided with at least one cutting edge 19 in the forward end thereof facing away from the drill body 12, which tip is given different designs depending on the area of application.

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The drill tip 11 is made of hard material, preferably cemented carbide and most preferably of injection molded cemented carbide, and comprises a front cutting surface formed by two upper clearance faces 15, a lower support surface 16 as well as first and second curved surfaces 41, 18 interconnecting the surfaces 15 and 16. All these surfaces and associated edges are integrated as one piece with the drill tip and consequently formed of the same material, i.e. preferably injection molded cemented carbide. The curved surfaces 18 form front chip flutes for conducting cuttings rearwardly. Lines of intersection between the chip flutes 18 and the clearance faces 15 form main cutting edges 19, preferably via reinforcing chambers, not shown. Lines of intersection between the first curved surfaces 41 and the chip flutes 18 form secondary cutting edges 19'. The chip flute is shown as helical but may alternatively be adapted for a drill body requiring straight chip flutes. The radially external parts between the chip flutes consist of protruding lands formed by the surfaces 41, each having a circumferential length G (FIG. 4). The largest diameter of the drill tip is the diametrical distance between the radially extreme points of the secondary cutting edges. The height of the drill tip is substantially the same as the largest diameter of the tip, in order to minimize the wear from chips on the joint between the drill tip and the drill body. Flushing holes 23, extending substantially parallel with the rotational axis 22, extend through the drill tip from the support surface 16 to the orifice in respective upper clearance surface 15.

The support surface 16 according to FIGS. 2, 3 and 3A is substantially planar but comprises a recess 50 at the transition between the support surface 16 and the land 41. Each recess 50 comprises a first free or end surface 51 perpendicularly connected to both the land 41 and a second free surface 52 (see FIG. 8), which surface 52 in turn forms an acute angle  $\alpha$  with a first guiding surface 53 (see FIG. 6). The surface 53 connects to a second guiding surface 54 oriented parallel to the rotational axis 22, and which connects to the support surface 16 via a radius or an entering bevel 55. The surface 53 is inclined obliquely relative to the center axis 22 so as to face generally radially inwardly and longitudinally rearwardly. As illustrated in FIG. 3, support surface 16, recesses 50, and land 41 define a generally dovetail-shaped projection. The recess 50 has a stop surface 56 (FIG. 3A) which is parallel to the axis 22 and which suitably lies in an axial plane which intersects said axis. The recess 50 extends in a tangential direction from the chip flute 18 to about a midpoint of the circumferential length G of the associated land 41.

The drill body is made of a material which has a lower Young's modulus than cemented carbide. The drill body has helical rear chip flutes 18A (or straight chip flutes if required) and these can extend along the entire outer surface of a shank portion 40 of the body or along only a part thereof. The drill body 12 is provided with a front surface 24 at the end facing towards the drill tip 11, which surface 24 abuts against the support surface 16 of the drill tip 11. The largest diameter of the support surface 16 is larger than the largest diameter of the front surface 24 in order to minimize the wear from chips on the joint between the drill tip and the drill body. The drill body also includes curved surfaces 41A forming lands. The front surface 24 is substantially planar but comprises a projection 60 at the transition between the front surface 24 and the jacket surface of each land 41A. The height of the projection is somewhat less than that of the depth of the recess 50.

Each projection 60 comprises a first free or end surface 61 perpendicularly connected to the jacket surface 41A, said

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surface 61 also perpendicularly connected to a second free surface 62, which in its turn forms an acute angle  $\pi$  with a first guiding surface 63. The surface 63 connects to a second guiding surface 64 oriented parallel to the rotational axis 22. The surface 64 connects to the front surface 24 via a radius 65. The surface 63 is oriented parallel to the surface 53 so as to face generally radially outwardly and longitudinally forwardly. As illustrated in FIG. 5, the above-described surfaces, along with front surface 24, form a centrally disposed generally dovetail-shaped recess. The projection 60 has a stop surface 66, FIG. 9, which is parallel with the axis 22 and which suitably lies in an axial plane which contains said axis.

The smallest diameter of the front surface 24 is smaller than the largest diameter of the drill tip but larger than the smallest diameter of the drill tip. The projection 60 extends in a tangential direction from the chip flute 18A to about the midpoint of the circumferential tangential length G' of the associated land 41A.

The stop surfaces 56 and 66, respectively, should be as far from the rotational axis as possible for best moment transfer, i.e. they are arranged diametrically opposed each other. The drill tip must be symmetrically formed in order to retain the tool's concentricity at varying strain, i.e. in order to keep the drill tip centered relative to the drill body. The projections 60 and the recesses 50 lie at a distance from and substantially rearwardly of the associated cutting edge 19 in the tool's rotational direction R.

Mounting of the drill tip 11 on the drill body 12 is done as follows. The drill tip 11 is brought in the axial direction towards the drill body 12, so that each projection 60 is received in the associated chip flute 18 and so that the support surface 16 abuts against the front surface 24 thereby bringing the generally dove-tail shaped projection of the drill tip 11 into mating engagement with the generally dovetail-shaped recess of drill body 12. Then, the drill tip is rotated in the direction R within an angle interval  $\phi$  which is less than  $360^\circ$ , preferably less than  $60^\circ$ , relative to the drill body so that each projection 60 moves with a slide fit in the respective recess 50 until the stop surfaces 56 and 66 abut against each other. The drill tip 11 is now anchored in the drill body 12 in a satisfactory manner. Thus, the preformed spaces defined by the chip flutes 18 are used as the entrance and the exit of the bayonet coupling.

When the drill tip 11 must be replaced, the mounting procedure is reversed. The drill tip 11 then can be removed from the drill body 12 and be exchanged, preferably with the aid of a suitable key in engagement with the chip flutes on the drill tip. The key is preferably also used during mounting of the drill tip.

The surfaces which during the drilling operation must be in engagement are surfaces 53 and 63 as well as the support surface 16 and the front surface 24. The surfaces 53 and 63 cooperate to hold the drill tip such that it cannot loosen in the feed direction, for example during retraction of the tool. The surfaces 53 and 63 are preferably designed such that their cooperation results in some elastic deflection of the projection 60 due to the slide fit. A limited contact surface between surfaces 54 and 64 can be allowed, but this implies an increased moment at the radius 65. The drill tip is self-centering in the tool body, i.e. it moves such that its axis coincides with the rotational axis 22 if it has been displaced during the machining operation. The surface 55 will allow the radius 65 of the tool body to be relatively large. The surfaces 52 and 62 should not be in engagement with each other during the machining operation. That is realized by

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extending the surface 53 (see FIG. 6). The clearance surfaces 51 and 61 should not be in engagement with each other during the machining operation, and therefore a gap P is always present between them (see FIG. 6). The gap P is in the range of 0.1–1.0 mm. The support surface 16 will be pressed by the feed force against the front surface 24 during the machining operation, which means that the elastic deflection of the projection 60 tends to decrease somewhat, which however is counteracted because the projection 60 will be bent radially inwardly due to pressure on the front surface 24 from the feed force.

The invention is useable also for milling cutters. The drill tip is preferably coated with layers of, for example,  $Al_2O_3$ , TiN and/or TiCN. In certain cases, it can be well-founded to apply super hard material such as CBN or PCD on the cutting edges. Alternatively ceramic material can be used at injection molding of the drill tips.

Although the present invention has been described in connection with a preferred embodiment thereof, it will be appreciated by those skilled in the art that additions, modifications, substitutions and deletions not specifically described may be made without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A rotary metal-cutting tool comprising, in combination, a tool body and a cutting portion attached to the tool body; the tool body including: a shank portion defining a longitudinal center axis, a front surface, and rear chip flutes formed in an external side surface of the shank for guiding chips rearwardly during a cutting operation; the cutting portion including: a rear support surface abutting the front surface, a front cutting surface, and front chip flutes formed in a side surface of the cutting portion and intersecting the cutting face to form cutting edges therewith; the tool body and cutting portion being interconnected by a dovetail-shaped bayonet coupling formed by projections disposed on one of the tool body and cutting portion, and recesses formed in the other of the tool body and cutting portion, the projections being circumferentially offset with respect to the flutes and extending generally longitudinally; the recesses extending circumferentially from respective flutes; the flutes sized to longitudinally receive respective projections during longitudinal insertion or removal of the cutting portion relative to the tool body; the cutting portion being rotatable about the center axis relative to the tool body to transfer the projections from the respective flutes into the recesses while bringing the front and rear flutes into mutual alignment.
2. The tool according to claim 1 wherein the recesses are formed in the cutting portion; and the projections are formed in the tool body.
3. The tool according to claim 1 wherein the recesses are formed in the outer surface of the cutting portion; the cutting portion being rotatable relative to the tool body by an angle less than 360 degrees.
4. The tool according to claim 3 wherein the angle is less than 60 degrees.
5. The tool according to claim 1 wherein each of the projections includes a first surface inclined obliquely relative to the center axis, the first surface facing generally radially inwardly and longitudinally rearwardly; each of the recesses including a second surface inclined obliquely relative to the center axis, the second surface facing generally radially outwardly and longitudinally forwardly and oppos-

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ing a respective first surface to prevent relative longitudinal movement of the cutting portion relative to the tool body.

6. The tool according to claim 5 wherein a material from which the tool body is formed has a lower Young's modulus than a material from which the cutting portion is formed, to enable the projections to bend elastically in a radial direction during relative rotation between the cutting portion and tool body.

7. The tool according to claim 1 wherein each of the projections includes a first surface inclined obliquely relative to the center axis, the first surface facing generally radially inwardly and longitudinally rearwardly; each of the recesses including a second surface inclined obliquely relative to the center axis, the second surface facing generally radially outwardly and longitudinally forwardly and opposing a respective first surface to prevent relative longitudinal movement of the cutting portion relative to the tool body.

8. The tool according to claim 6 wherein the outer surface of the cutting portion defines a pair of lands extending circumferentially by equal distances between the front flutes, each of the recesses extending circumferentially for a distance of about one-half of the circumferential distance of a respective land, each of the projections extending circumferentially a distance substantially equal to that of a respective recess.

9. The tool according to claim 1 wherein each of the projections includes a first surface inclined obliquely relative to the center axis, the first surface facing generally radially inwardly and longitudinally rearwardly; each of the recesses including a second surface inclined obliquely relative to the center axis, the second surface facing generally radially outwardly and longitudinally forwardly and opposing a respective first surface to prevent relative longitudinal movement of the cutting portion relative to the tool body.

10. The tool according to claim 1 wherein each of the projections includes a forwardly facing end surface, and the recess includes a forwardly facing end surface, and the recess includes a rearwardly facing end surface spaced from the forwardly facing end surface by a gap.

11. A cutting portion adapted to be connected to a tool body for rotary metal cutting, comprising a front cutting surface having at least one cutting edge, a rear support surface, and at least one chip flute formed in a side surface of the cutting portion for guiding cuttings, said cutting portion including coupling means defining a dovetail-shaped projection and forming part of a bayonet coupling adapted to connect a tool body with the cutting portion.

12. The cutting portion according to claim 11 wherein the coupling means comprises a recess extending circumferentially less than 60 degrees.

13. A rotary drill comprising:

- a drill body having a longitudinal axis and first and second opposed ends, one of said opposed ends comprising a centrally disposed dovetail-shaped recess, and at least two circumferentially spaced projections, each of said projections having a stop surface;
- a replaceable drilling head having first and second opposed ends, one of said opposed ends comprising a cutting portion, and the other of said opposed ends comprising a dovetail-shaped projection, said drilling head further comprising at least one stop surface.

14. A method of attaching a drilling head to a drill body, said drill body having a longitudinal axis and first and second opposed ends, one of said opposed ends comprising a centrally disposed dovetail-shaped recess, and at least two circumferentially spaced projections, each of said projections having a stop surface; said drilling head having first

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and second opposed ends, one of said opposed ends comprising a cutting portion, and the other of said opposed ends comprising a dovetail-shaped projection, said drilling head further comprising at least one stop surface; wherein said method comprises:

inserting said dovetail-shaped projection into said dovetail-shaped recess; and

rotating said drilling head relative to said drill body such that the at least one stop surface on said drilling head comes into engagement with at least one of the stop surfaces on one of the projections.

15. A method for mounting a cutting portion to a tool body to form a metal-cutting rotary tool; the tool body including a shank portion; a front surface, and rear chip flutes formed in an outer surface of the tool body; the cutting portion including a support surface abutting the front surface, a cutting surface having cutting edges, and front chip flutes formed in an outer surface of the cutting portion; one of the tool body and cutting portion including longitudinal

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projections, and the other of the tool body and cutting portion including circumferential recesses, each recess communicating with a respective flute and extending less than 180 degrees; the method comprising the steps of:

5 A) converging the cutting portion and tool body longitudinally toward one another to bring the projections into respective ones of the flutes that communicate with the circumferential recesses; and

10 B) effecting relative rotation between the tool body and cutting portion to cause the projections to enter respective ones of the recesses to bring the front flutes into alignment with the rear flutes, and to bring a stop surface of each projection into longitudinally opposing relationship with a stop surface of a respective recess for defining a dovetail-shaped bayonet connection preventing longitudinal displacement of the cutting portion relative to the tool body.

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